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PRIMARY PERCUTANEOUS CORONARY INTERVENTIONS NETWORK IN BOSNIA AND HERZEGOVINA

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Abstract

Reperfusion therapy remains the most effective treatment for patients suffering from acute coronary syndrome. The start time of reperfusion therapy is an important factor, and has a positive influence in reducing the number of days of hospitalisation, occurrences of readmission, risk of reinfarction, and both short and long-term mortality. Several models of reperfusion therapy are available: thrombolytic treatment (pre-hospital or in-hospital), primary percutaneous coronary intervention (primary PCI [pPCI]), or a combination of both. PPCI is the preferred treatment (and should be administered as early as possible) in centres with experienced teams, especially for patients in cardiogenic shock, or those with contraindicated fibrinolytic (TL) therapies. Many randomised clinical trials have shown that pPCI is superior to TL in reducing mortality, reinfarction, and stroke.

Our aim is to describe the easiest and quickest way of establishing the primary PCI network in Bosnia and Herzegovina.

It is possible, by combining the efforts of both entities of Bosnia and Herzegovina, to establish a functional and effective PCI network, particularly since Bosnia and Herzegovina has become a participant in the Stent for Life initiative.

Key words: Acute coronary syndrome, primary percutaneous coronary intervention network, Stent for Life initiative

Introduction

Reperfusion therapy is the most effective treatment for patients suffering from acute coronary syndrome (ACS). Early application of reperfusion therapy is an important factor, which has a positive impact on the overall outcome of ACS by reducing

short and long-term mortality, number of days' hospitalisation, readmission, and risk of reinfarction. Today, several models of reperfusion therapy are available: thrombolytic (TL) treatment (pre-hospital or in-hospital), primary percutaneous coronary intervention (primary PCI or pPCI), or a combination of both. Many randomised clinical trials (1-5) have shown that pPCI is superior to TL in reducing mortality, re-infarction, and stroke. PPCI is preferred (and should be administered as early as possible) in centres with experienced teams, especially for patients in cardiogenic shock, or those with contraindicated fibrinolytic therapy.

The same recommendations are pertinent to cases of unstable or recurrent angina associated with dynamic ST deviations, cardiac failure, life-threatening arrhythmia, or hemodynamic instability.(6-7) Although the European Cardiac Society (ESC) has made detailed guidelines for the primary PCI treatment of ACS, this treatment is not implemented in many countries (GRACE, EuroHeart Survey). For this reason, thrombolysis is still the most common reperfusion therapy in some European countries, especially Eastern and South-Eastern Europe. Additionally, a large percentage of patients do not receive reperfusion treatment at all.

Data collected from national societies of cardiology/working groups for emergency and interventional cardiology are:

1. National STEMI and PCI registers
2. Epidemiology and treatment of STEMI
3. The number of PCI and primary PCI procedures and number of PCI centers.

This data (8, 9) shows that the situation is better in countries where primary PCI is applied in the majority of ACS cases, such as in many Western and Central European countries. In order to improve the situation elsewhere, EAPC, EuroPCR, and the ESC Working Group on Acute Cardiac Care (in cooperation with Euromedic), created the Stent for Life (SFL) project.

SFL objectives are:

1. To increase the use of primary PCI over 70% of STEMI
2. To reach 600 primary PCI per million/per year
3. To provide 24/7 primary PCI services

Our goal is to describe the current situation of the pPCI network in Bosnia and Herzegovina, and to propose the easiest feasible way to properly establish it

Methods and results

Bosnia and Herzegovina has an area of 51.129 km², with a GDP of \$8,400 (nominal GDP \$4940), and an estimated population of 3.900.000 (2014 census). According to this and other, broader economical data, it is categorised as a middle-income country.

Interventional cardiology is a relatively young discipline in clinical practice in Bosnia and Herzegovina. We have 5 interventional cardiology centers throughout

the country, completing more than 2500 interventional procedures and about 8000 diagnostic cardiology invasive procedures. There are only 18 independent trained interventional cardiologists in the country, although some young interventional cardiologists are currently finishing their training.

According to data collected from the Working Group for Interventional Cardiology of the Association of Cardiologists of Bosnia and Herzegovina in 2010, most STEMI patients received thrombolysis (40%) and medical treatment (>50%), while a very small number (<10%) were treated by pPCI procedures.(10) From 2012–2013, the number of pPCI procedures increased by up to 15%.

For the SFL survey, we conducted a study on myocardial infarction treatment in BiH in 2011. As a result of this survey, we found that more than 42% of patients with acute myocardial infarction (AMI) and ST elevation (STEMI), remained unreperfused and were treated conservatively, with a high mortality rate (although there is no statistical data, estimates range from 12-15%). Only 15% (126 per million) patients with STEMI, are treated by primary PCI, as required by ESC guidelines.(11) A major problem lies in transportation time to PCI centres. Most patients arrive at treatment centres with their own transportation, and not by EMS.

Dr Ibrahim Terzić, president of the Working Group for Interventional Cardiology of the Association of Cardiologists of Bosnia & Herzegovina, and champion of the SFL initiative for B&H, signed up to the Stent for Life initiative on behalf of the Association of Cardiologists of B&H in 2012, during the ESC congress in Munich.

Table 1. Data collected from the Working Group for Interventional Cardiology of the Association of Cardiologists of B&H, in 2013.*

Data*	2013
Interventional cardiologists	24
PCI centres	5
PCI in total	2195
PCI per centre	439
PCI per operator	91
Primary PCI /PCI in total	15%
Radial access	20%

Table 2. PCI Centres and Procedures

PCI conditions	
PCI centres	5
PCI/mil.	579
PPCI/mil.	149
Annual MI admissions	6954
Annual STEMI	3122

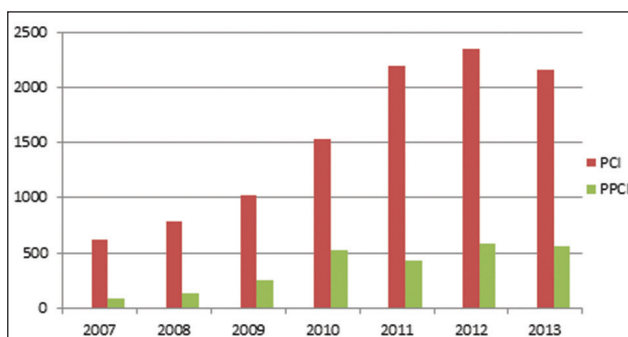


Figure 3. Evolution of Primary PCI in Bosnia and Herzegovina (2007–2013)

Discussion

The Political Situation in B&H

Bosnia and Herzegovina has three main levels of government:

1. The Council of Ministers is the highest political State level, with 9 ministries. There is currently no Ministry of Health at State level.
2. The Government of the Federation of Bosnia and Herzegovina, with 17 ministries, 9 departments, 5 offices and services, and one special federal body.
3. The Government of Republika Srpska, with 16 ministries, 7 representative offices, 2 offices and services.

There are two Ministries of Health at entity level. Additionally, the Federation of B&H has ten Federal Cantons, each with its own Cantonal Ministry of Health.

Due to the complex political organisation and overall situation in the country, the main problem for the pPCI network is not medical, but political. Political consensus on the organisation of the pPCI must first be reached before the network can proceed. Unfortunately, no such consensus currently exists for the establishment of pPCI, which would cover the whole territory of the country.

Public Campaign and Patient Awareness of pPCI

Although we try to educate our citizens, much more needs to be done. The greatest problem in this regard is late presentation of patients with chest pain. As a first step, relevant information should be disseminated in a public campaign through the media (newspapers, TV and radio). A broad-reaching public campaign must be started as soon as possible, in order to increase the number of citizens with awareness of chest pain, and with basic cardiopulmonary resuscitation skills.

Emergency Medical Services

An emergency phone number for all emergent medical situations in B&H has not yet been established. Most patients arrive at hospitals by EMS, which is required to

reach patients anywhere in B&H within 30 minutes. After the onset of symptoms, (i.e. chest pain), every patient should receive medical attention, on-site first aid, and urgent transportation. Awareness of the emergency phone number combined with rapid EMS response will result in greater success, and an increase of the pPCI reperfusion strategy.

EMS is currently provided by some hospitals and general practices. Its main problem is a loss of time in transportation, due to its disorganised nature, and the fact that the majority of patients are first transported to the local hospital, which often has no cath lab facilities. This problem can be overcome by reorganising EMS as part of the B&H pPCI network organisation.

Activity of the Association of Cardiologists of Bosnia & Herzegovina

In the last five to six years, three new PCI centres have opened (a private centre in Tuzla, and state-run centres in Banja Luka, and, most recently, Mostar.) Not long ago, the Association of Cardiologists of Bosnia & Herzegovina acquired conditions to establish a pPCI network in B&H. To realise this goal, health care professionals must be supported by the Ministry of Health, and will need to organise a campaign on “chest pain and emergency telephone number” awareness. The relevant information should first be presented through newspapers, as well as on TV and the radio. At the moment, there is no national PCI registry or unique ACS call centre number.

Collaboration of the Association of Cardiologists of Bosnia & Herzegovina and the Ministry of Health

To begin organisation of the pPCI network, the most effective strategy is to first implement a small, local pPCI network, with a good local database. The first big medical step is to shorten the amount of time from onset of chest pain to first medical contact. Transportation from one well-organised regional hospital, with good personal relations between colleagues, to the nearest pPCI centre, is a good start in the solving of EMS problems. After the first successful year is completed, other colleagues will be able to join the network. The Association of Cardiologists of B&H and the Ministry of Health should immediately organise national registries for ACS (or AMI), which will evaluate the incidence, treatment and outcome of hospitalised patients with potentially dangerous illnesses (STEMI, NSTEMI, IAP), and serve to improve the system. A national registry will also provide a useful and important tool for quality control. The Association of Cardiologists of B&H and the Ministry of Health should organise a campaign on “chest pain and emergency telephone number” awareness. This should include a public campaign to inform the population about the PCI network, and to clarify that pPCI confers a significant additional survival benefit.

Close cooperation between the Association of Cardiologists of B&H and the government (through the Ministry of Health) is absolutely necessary to achieve the effective implementation of primary PCI programs.

Network and Infrastructure

One primary PCI centre should cover around 0.5 million inhabitants (0.3-1 million). Regional networks must have a coordinating body that will organise annual meetings and education, and ensure protocols are followed. For these activities, we must respect the wishes of local hospitals and their cardiologists. A 24/7 service for PCI hospitals should be established, and those hospitals that cannot provide this service should not be part of the network. Non PCI hospitals must provide cardiologists with a 24/7 service for the adequate care of AMI patients. Without close relations with EMS and local hospitals, the pPCI network cannot be established. The key message is that we need to provide education for staff of primary health care centres and the EMS, and to develop appropriate transport protocols.(8,9)

Our proposal for the pPCI network in B&H includes four regions with five pPCI centres: Sarajevo, Tuzla (2 centres), Banja Luka and Mostar. Transportation routes should be established on the basis of medical principles and guidelines (meaning transport to the nearest pPCI centre) and not on the basis of entity borders (Figure 4).

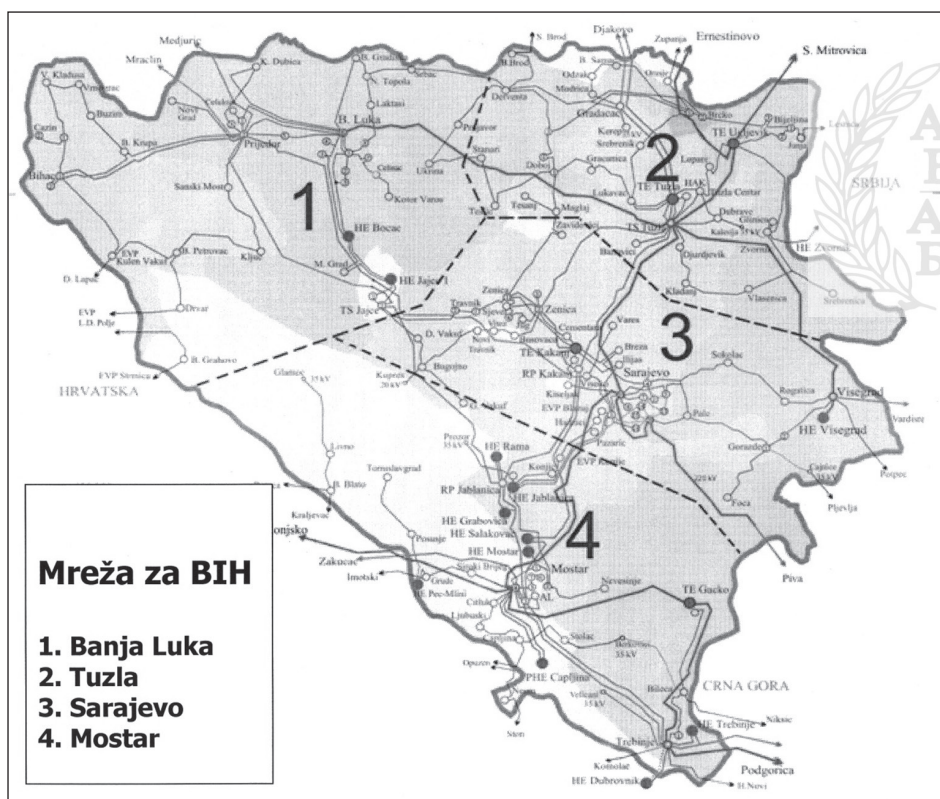


Figure 4. Proposal of pPCI network at State level, where the north-west (Una Sana Canton) is directed to the PCI center in Banja Luka, the north-eastern part of Republika Srpska to PCI centres in Tuzla, the eastern part of RS to the PCI centre in Sarajevo, and east Herzegovina to the PCI centre in Mostar.

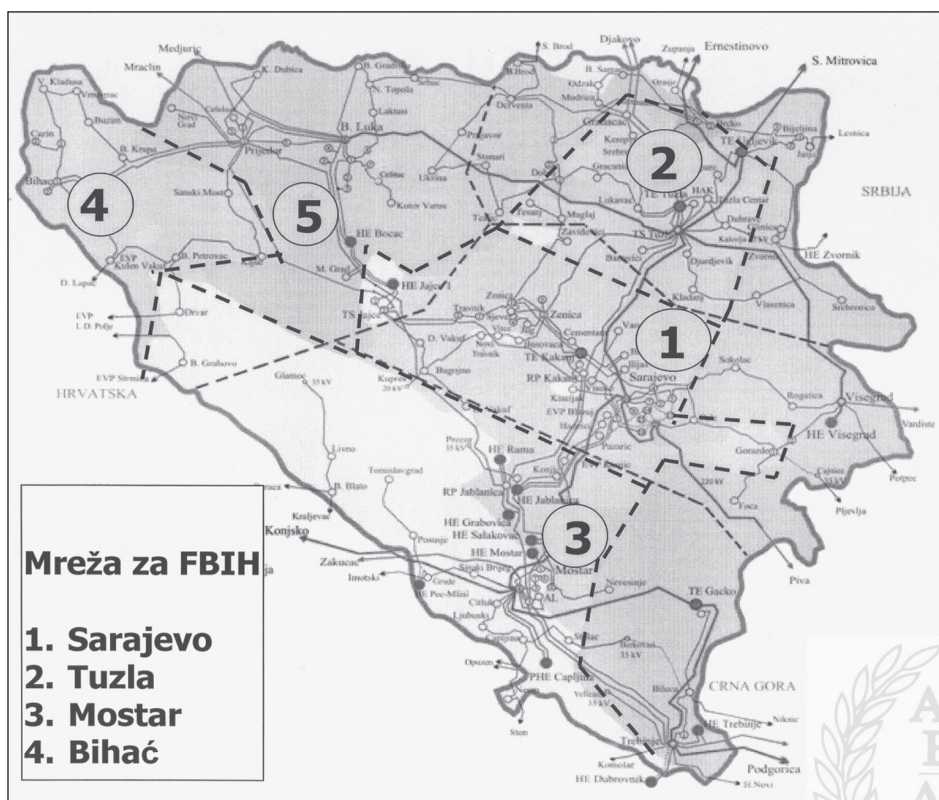


Figure 5. Proposal of the pPCI network for the Federation of Bosnia and Herzegovina: pPCI centres in Sarajevo, Tuzla and Mostar cover most of the Federation's territory, but Una Sana Canton remains a problem because of long-distance transportation.

Different organisations of cath labs

In a situation when one primary PCI center covers a population of between 0.3 and 1.1 million per PCI centre (non-stop, 24/7) there are approximately 200-800 primary PCI procedures/year/centre. The population per centre <0.3 million results in low numbers of STEMI, and thus the experience of the team may not be sufficient in low-volume centres. The optimal case volume would be between 50 and 100 primary PCIs/operator/year (12,13). Our data from 2013 showed a total of 2195 PCI procedures per year, with a PCI/centre of 439/y, PCI/operator of 91/y, and finally, the number of primary PCI/total PCI at 15% (Fig 1.). Primary PCI numbers in B&H show a slightly lower rate of PCI and pPCI in 2013, compared with the period 2011-2012, mostly because of financial health care problems (Fig. 2, 3).

Variations exist in the organisation and model of cath lab team structures. The most economical of these is to have an interventional cardiologist on call, a nurse constantly in the cath lab (24/7), and to include staff from intensive care and coronary units where necessary. This means that two extra members of the team should be paid outside their

regular working hours. An expanded team should consist of one senior interventional cardiologist, an interventional cardiologist in training, plus two nurses and one technician. Thus, five extra team members should be paid outside normal working hours. A specialist nurse should be permanently on-site (for preparation of materials, etc.), while other team members could arrive within 30 minutes of being called.

EMS, Transportation and Time Delays

EMS should transport the patient directly to the cath lab, within 90 minutes. If the PCI centre is not the first port of call, transport to a PCI center usually requires an additional 30-60 minutes. If the patient is transported to the intensive care unit of the PCI center and then forwarded to the cath lab, another 20-40 minutes is lost.

Finance

If using the International Refined Diagnosis Related Group (DRG) system, where each diagnosis and treatment has a specific code and corresponds to payment by insurance companies, funding is not a problem. In other cases, funding is a critical problem. Extra payment for out of hours staff in regional locations, and payments to motivate and increase the number of staff on the rota, must be established.

Barriers to the Implementation of Primary PCI

Reimbursement is only rarely a real problem. It is low staffing levels (including a lack of interventional cardiologists and/or nurses and other support staff) that prevent many smaller PCI hospitals running a non-stop (24/7) primary PCI service. Some conservative internists and even some noninvasive cardiologists, who still prefer to use TL instead of sending their patients to other cardiologists for pPCI, are most frequently the real barriers. Insufficient motivation of interventional cardiologists and/or nurses to run the non-stop (24/7) services (if they are not adequately paid for this activity), even when staffing is sufficient, is another barrier to the implementation of pPCI strategy.(13)

Conclusion

A well-organised pPCI network influences positively on: the number of days of hospitalisation; readmission; risk of reinfarction; and both short- and long-term mortality. A shorter symptom-onset-to-balloon time was associated with improved coronary flow, an increased likelihood of subsequent left ventricular systolic ejection fraction >40%, and greater 3-year survival in patients with ST-segment elevation myocardial infarction treated with pPCI.(14)

For a well-organised Primary Percutaneous Coronary Interventions network in Bosnia and Herzegovina we propose the following:

1. Agreement between the two Ministries of Health is very important, but so is a contract/agreement with the Public Health funds of both entities, and with insurance companies.

2. The definition of National Cardiology programs, protocols and guidelines for prehospital and hospital treatment, and transportation. The definition of primary PCI centers, with appropriate staffing, equipment, materials, and other needs. Recommendations on a national level are to combine and coordinate the efforts of all stakeholders in this program.
3. Public awareness of the symptoms of AMI and unstable angina, as well as the role of time in treatment (every minute is important).
4. An experienced EMS team has shown that a well-trained nurse can excellently serve to triage and transport patients with AMI. Training is more important than structure. The team must be equipped for resuscitation with necessary medication and 12-channel ECG.
5. An expanded team for pPCI procedures with one senior interventional cardiologist, an interventional cardiologist in training, plus two nurses and one technician. Thus, five extra staff members should be paid outside their normal working hours.
6. Becoming a Stent for Life affiliate country will give us the capacity to increase pressure on overall stakeholders in the country, in order to have support for different topics, including: funding for hospitals; additional fees for unmotivated PCI team members; and interventional cardiologists and technicians.
7. An increase in the education of young cardiologists to become independent interventional cardiologists and facilitate the primary PCI implementation program.
8. Political support from the governments to create this national platform, and to establish a national registry for ACS and PCI patients. Establishment of a national level network composed of EMS, regional non-PCI hospitals and PCI centres is required, and will allow us to have primary PCI access for at least 70% of STEMI patients, as suggested in the ESC guidelines.
9. The Stent for Life Initiative gives us a great opportunity to use and share the experiences of the other Stent for Life countries, who have already attained many outstanding achievements. We hope to develop a national network in the treatment of STEMI patients in the near future (2014-2015), and reach the following objectives:
 - 70% of STEMIs to be treated by primary PCI,
 - 600 STEMI per million to be treated by primary PCI,
 - 100% STEMIs to access invasive approaches (coronarography, and eventually PCI) within 24 hours.
10. Our goals must be: shortening of symptom onset-to-door time; shortening of door-to-balloon time; and shortening of symptom onset-to-balloon time, i.e. shortening of total ischaemic time.(15)

pPCI centres

- Our proposal for the pPCI network in B&H includes four regions with five pPCI centres.
- Sarajevo pPCI centre would serve Canton Sarajevo, Zenica-Doboj Canton, and the eastern part of the Republic of Srpska, nearest to Sarajevo.

- Tuzla (2 pPCI centres) for Canton Tuzla, District of Brčko, the northern part of Zenica-Doboj Canton, and the north-western part of RS, nearest to Tuzla.
- Banja Luka pPCI centre would serve the largest region of B&H, including Una Sana Canton, and parts of mid-Bosnia, nearest to Banja Luka.
- Mostar pPCI would serve Mostar, as the main PCI centre for the whole of Herzegovina.

In Bosnia and Herzegovina we still have a high proportion of patients left without reperfusion treatment. Countries in which all existing PCI centers offer 24/7 pPCI services appear to have the best pPCI results. In Bosnia and Herzegovina we have a substantial heterogeneity, and problems of medical practice due to treatment of STEMI patients, but still we have much room for improvement.

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